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PATENT AND TRADEMARK OFFICE

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Applicant(s)	:	Matthias WENDT et al.
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Title: STARTING-PROCESS CONTROLLER FOR STARTING A PIEZOMOTOR

APPEAL BRIEF

U.S. Patent and Trademark Office
Customer Window, Mail Stop **Appeal Brief - Patents**
Randolph Building
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Sir:

In response to the FINAL Office Action dated 12 September 2007, finally rejecting pending claims 10, 12-22 and 26, and in support of the Notice of Appeal filed on 6 November 2007, Applicants hereby respectfully submit this Appeal Brief.

REAL PARTY IN INTEREST

According to an assignment recorded at Reel 016581, Frame 0523, Koninklijke Philips Electronics N.V., owns all of the rights in the above-identified U.S. patent application.

RELATED APPEALS AND INTERFERENCES

There are no other appeals or interferences related to this application or to any related application, nor will the disposition of this case affect, or be affected by, any

other application directly or indirectly.

STATUS OF CLAIMS

Claims 1-9 and 11 are canceled, and claims 10 and 12-30 are pending.

Claims 10, 12-22 and 26 are rejected, and claims 23-25 and 27-30 are objected to as depending on a rejected claim.

Accordingly, the claims on Appeal are claims 10, 12-22 and 26.

STATUS OF AMENDMENTS

There are no pending amendments with respect to this application.

SUMMARY OF CLAIMED SUBJECT MATTER

The present invention is directed to a starting process controller for starting a piezoelectric motor.[1]

Accordingly, as broadly recited in claim 10, the starting-process controller for starting a piezomotor comprises: a voltage-controlled oscillator (VCO) (FIG. 3 – element 1), a power output stage (FIG. 3 – element 2; page 4, line 32), a resonance converter (FIG. 3 – element 3; page 4, line 32), a phase comparator (FIG. 3 – element 6; page 5, lines 9-10), a phase-locked loop filter (FIG. 3 – element 8; page 5, line 13) and an adjustable time-delay element (FIG. 3 – element 15; FIG. 6, element 15; page 5, lines 1-2). The VCO generates the control signals required for the power output stage (page 5, lines 6-7). The power output stage provides a stepped output voltage (page 3, lines 25-26). The resonance converter converts the stepped output voltage from the power output stage into a motor voltage for driving the piezomotor (page 3, lines 25-27; page 4, lines 33-34), the motor voltage being sinusoidal (page 3, line 27; page 4, line 34) and having an associated motor current when the

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1 In the description to follow, citations to various reference numerals, figures, and corresponding text in the specification are provided solely to comply with Patent Office rules. It should be understood that these reference numerals, figures, and text are exemplary in nature, and not in any way limiting of the true scope of the claims. It would therefore be improper to import anything into any of the claims simply on the basis of **exemplary** language that is provided here only under the obligation to satisfy Patent Office rules for maintaining an Appeal.

piezomotor is driven (page 5, line 6). The phase comparator compares the motor current with the phase of the motor voltage, and provides a phase-difference signal representing a measure of the phase difference between motor current and the motor voltage (page 5, lines 8-12). The phase-locked loop filter is configured to smooth the phase-difference signal so as to provide a smoothed signal that controls the VCO (page 5, lines 13-14). The adjustable time-delay element provides for controlled reduction of the phase difference between the motor voltage and the motor current in a start-up process for starting up the piezomotor from a large starting angle at initiation of the start-up process towards a smaller operating angle at an operating point (page 5, lines 1-5). The adjustable time-delay element effects the reduction in the form of one of: (i) a preset linear gradient (FIG. 5, curve 1; page 5, line 19), the linear gradient having a preset starting delay, a preset final delay and a preset, fixed change in delay per selected time increment over the duration of the start-up process (page 6, lines 3-13), such that, at initiation of the start-up process, the starting delay applies to generate a start-up phase angle (FIG. 6, φ_{start}) toward enabling reliable start up of the piezomotor (page 6, lines 8-9) and, at the operating point, the final delay applies to generate an operating phase angle (FIG. 6, φ_{lauf}) toward enabling reliable operation of the piezomotor (page 6, line 13), or (ii) a preset progressive curve (FIG. 5, curve 2; page 5, lines 21-24), the progressive curve having a preset starting delay, a preset final delay and a preset, varying change in delay per selected time increment over the duration of the start-up process, such that, at initiation of the start-up process, the starting delay applies to generate a start-up phase angle (FIG. 7, φ_{start}) toward enabling reliable start up of the piezomotor, and, as the operating point is neared, the change in delay per selected time (FIG. 7, f_{res}) increment becomes progressively smaller and, at the operating point, the final delay applies to generate an operating phase angle toward enabling reliable operation of the piezomotor (page 7, lines 9-10), or (iii) a preset combination of a linear gradient and a progressive curve (page 5, lines 24-25; page 2, line 31).

As broadly recited in claim 26, a starting-process controller for starting a piezomotor, comprises: a voltage-controlled oscillator (VCO) (FIG. 3 – element 1) adapted to generate a control signal; a power output stage (FIG. 3 – element 2; page

4, line 32) adapted to receive the control signal from the VCO and in response thereto to generate a stepped output voltage (page 3, lines 25-26); a resonance converter (FIG. 3 – element 3; page 4, line 32) adapted to convert the stepped output voltage from the power output stage into a motor voltage for driving the piezomotor (page 3, lines 25-27; page 4, lines 33-34), the motor voltage being sinusoidal (page 3, line 27; page 4, line 34) and having an associated motor current when the piezomotor is driven (page 5, line 6); an adjustable time-delay element (FIG. 3 – element 15; FIG. 6, element 15; page 5, lines 1-2) adapted receive the motor current and to delay the motor current by a delay amount; a phase comparator (FIG. 3 – element 6; page 5, lines 9-10) adapted to receive the motor voltage and the delayed motor current from the adjustable time-delay element, and to output a phase-difference signal representing a measure of a phase difference between the delayed motor current and the motor voltage (page 5, lines 8-12); and a phase-locked loop filter (FIG. 3 – element 8; page 5, line 13) adapted to filter the phase-difference signal and to apply the phase-difference signal to the VCO (page 5, lines 13-14).

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

The grounds of rejection to be reviewed on Appeal are: (1) the rejections of claims 10 and 12-22 under 35 U.S.C. § 103 over Sakurai U.S. Patent 4,965,532 ("Sakurai-I") in view of Sakurai et al. U.S. Patent 6,569,100 ("Sakurai-II"); (2) the rejection of claim 26 under 35 U.S.C. § 103 Sakurai I.

ARGUMENTS

(1) Claims 10 and 12-22 Are All Patentable Over Sakurai-I and Sakurai-II

Claim 10

Among other things, the starting-process controller includes an adjustable time-delay element.

Applicants respectfully submit that the cited art, and in particular Sakurai I, does not include the adjustable time-delay element of claim 10.

The Examiner cites "item 12" of Sakurai I as supposedly corresponding to the adjustable time-delay element of claim 10.

Applicants respectfully disagree.

"Item 12" in Sakurai I is a phase lock loop (PLL) that consists of VCO 17, loop filter 16, and phase comparator 15.[2]

PLL 12 is not an "adjustable time delay element."

PLL 12 does not time-delay any signal.

Indeed, in the Final Office Action, the Examiner states that:

> So, while Sakurai may not directly affect a time-delay in the current and/or voltage, it indirectly does so in its adjustments to the output signal, which are illustrated in Figures 8A-8D.

However, that is clearly not what Applicants have claimed in claim 10. Applicants did not merely claim means for indirectly providing for controlled reduction of the phase difference between the motor voltage and the motor current in a start-up process." Instead, Applicants have very clearly claimed a controller which features a real, actual, ***adjustable time-delay element*** providing for controlled reduction of the phase difference between the motor voltage and the motor current in a start-up process.

Applicants respectfully submit that neither Sakurai I nor Sakurai II nor any combination thereof discloses or suggest such an adjustable time-delay element.

So no combination of Sakurai I and Sakurai II could ever produce the controller of claim 10.

Furthermore, in any event, PLL 12 does not "*provide for controlled reduction of the phase difference between the motor voltage and the motor current in a start-up process for starting up the piezomotor from a large starting angle at initiation of the*

2 Applicants also respectfully note that elements 17, 16 and 15 have already been cited as corresponding to the separately recited elements of claim 10: the VCO, loop filter, and phase comparator, and therefore cannot correspond to the separately-recited adjustable time-delay element.

start-up process towards a smaller operating angle at an operating point," as recited in claim 10.

Indeed, **nothing** in the cited FIG. 3 of Sakurai-I provides for controlled reduction of the phase difference between the motor voltage and the motor current in a start-up process for starting up the piezomotor from a large starting angle at initiation of the start-up process towards a smaller operating angle at an operating point. This is quite obvious from a simple inspection of FIGs. 8A-D of Sakurai-I, which clearly show that the phase difference $\Delta\theta$ cycles periodically between both positive and negative values during initial start-up.

Meanwhile, as explained in the present specification at page 2, lines 3-5 and 33-34 a starting-process controller for piezoelectric motors, as recited in claim 10, must insure that the phase angle remains in the capacitive range (positive angles) (see also page 1, line 18 - page 2, line 3. In contrast, as shown in FIGs. 8A-D where it is seen that the phase angle goes into the inductive range (negative angles), Sakurai-I does not provide this assurance that is required for a piezomotor controller.

Indeed, FIG. 3 of Sakurai-I is not concerned in the least bit with reducing the phase difference between the motor voltage and the motor current in a start-up process for starting up the piezomotor. Instead, FIG. 3 of Sakurai-I is only concerned with locking the PLL ***frequency*** to the resonant frequency of ultrasonic vibrating element 11 using resonant point detector 22 (while preventing the PLL from locking onto an anti-resonant frequency, such as f1 or f2 as shown in FIG. 8D – which is why the impedance signal is also provided to resonant point detector 22). Indeed, Sakurai-I very clearly teaches that the reference signal generating circuit 18 should be employed until the phase difference between the voltage and the current applied to vibrating element 11 is ***zero*** (!) - which according to Sakurai-I, indicates that the resonant frequency point has been achieved.

In summary, neither PLL12 nor anything else in FIG. 3 of Sakurai-I provides an adjustable time-delay element for controlled reduction of a phase difference between a motor voltage and a motor current in a start-up process for starting up the piezomotor from a large starting angle at initiation of the start-up process towards a smaller operating angle at an operating point.

Furthermore, as noted above and as is extremely clear from inspection of FIG. 8D of Sakurai-I, nothing in FIG. 3 of Sakurai-I effects a reduction of the phase difference between the motor voltage and the motor current from a large starting angle at initiation of the start-up process towards a smaller operating angle at an operating point, either ***in the form of***: (1) a preset linear gradient; (2) a preset progressive curve where, as the operating point is neared, the change in delay per selected time increment becomes progressively smaller: or (3) a combination of (1) and (2).

Finally, Applicants respectfully continue to traverse the proposed combination of Sakurai-I and Sakurai-II. The Examiner has stated that "*it would have been obvious to a person of ordinary skill in the art to combine the voltage-current phase comparator of Sakurai et al. with the starting-process controller of Sakurai for the benefit of eliminating the need for an additional reference signal*." See Final Office Action December 20, 2006, Page 3. If the Examiner is indeed relying on the general knowledge of one of ordinary skill in the art in combining the voltage-current phase comparator of Sakurai-I with the starting-process controller of Sakurai-II, then the Examiner has failed to properly support such reliance. In instances where the general knowledge of one of ordinary skill in the art is asserted, "that knowledge must be articulated and placed on the record. The failure to do so is not consistent with either effective administrative procedure or effective judicial review." See In Re Sang Su Lee, 277 F.3d 1338, 1345 (Fed. Cir. 2002). Therefore, the proposed combination is unsupported by objective evidence in the record, and therefore respectfully submitted to be improper.

Furthermore, Applicants respectfully submit that the cited elements of the two references – one pertaining to a VCO PLL, and the other to a direct digital synthesizer (DDS) circuit – are not combinable either physically, or logically – as anyone of even basic skill in the art for frequency synthesizer design knows and understands

Accordingly, for at least these reasons, Applicants respectfully submit that the rejection of claim 10 is clearly defective and should be withdrawn.

Claims 12-22

Claims 12-22 depend from claim 10 and are deemed patentable for at least the reasons set forth above with respect to claim 10. Applicants also respectfully submit that several of the features specifically recited in the depending claims, are clearly missing from the cited references.

Accordingly, for at least these reasons, Applicants respectfully submit that the rejections of claims 12-22 are also defective and should be withdrawn.

(2) Claim 26 is Patentable Over Sakurai-I

Among other things, the starting-process controller of claims 26 includes an adjustable time-delay element adapted receive the motor current and to delay the motor current by a delay amount, and a phase comparator adapted to receive the motor voltage and the delayed motor current from the adjustable time-delay element, and to output a phase-difference signal representing a measure of a phase difference between the delayed motor current and the motor voltage.

Applicants respectfully submit that the cited art does not disclose or suggest these features.

However, the Examiner states – without any further analysis – that these features "*have not been given patentable weight, as they do not positively recite any structural elements*."

Applicants respectfully submit that this is clear error.

At the outset, it is very well established that an apparatus claim may recite features in a wide variety of ways that do not merely "positively recite structural elements." Indeed, for example, 35 U.S.C. § 112, 6th paragraph specifically states that a claimed structure may be described in terms of its function, instead of just "positively recite any structural elements."

Given the literally tens of thousands of U.S. patents issued by the USPTO wherein features recited using the phrase "*adapted to*" have distinguished the claims over the prior art, surely the Board of Patent Appeals will not take a position at this time that any and all claim features recited with the language "*adapted to*," on their

face, carry no patentable weight.

Indeed, M.P.E.P. § 2111.04 states that:

> *The determination of whether each of these clauses is a limitation in a claim depends on the specific facts of the case. In Hoffer v. Microsoft Corp., 405 F.3d 1326, 1329, 74 USPQ2d 1481, 1483 (Fed. Cir. 2005), the court held that when a "'whereby' clause states a condition that is material to patentability, it cannot be ignored in order to change the substance of the invention."*

Here the "adapted to" features recited in claim 26 are material to patentability and cannot be ignored. If these features were read-out of the claim as the Examiner has attempted to do here, then the claim would read like nothing more than a grab-bag collection of unassociated components having no relationship to each other. Indeed, the relationships between the components that define the claimed subject matter are set forth by describing the way in which the various components are adapted to interact with each other . . . just as has been done by tens of thousands of issued and presumptively valid U.S. patents.

Accordingly, for at least these reasons, Applicants respectfully submit that the rejection of claim 26 is clearly defective and should be withdrawn.

CONCLUSION

For all of the foregoing reasons, Applicants submit that claims 10, 12-22 and 26 are all patentable over the cited prior art. Therefore, Applicants respectfully request that the rejections of claims 10, 12-22 and 26 be withdrawn, the claims be allowed, and the application be passed to issue.

Respectfully submitted,

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CLAIMS APPENDIX

1-9. (Canceled)

10. (Previously Presented) A starting-process controller for starting a piezomotor, comprising:

- a voltage-controlled oscillator (VCO), a power output stage, a resonance converter, a phase comparator, a phase-locked loop filter and an adjustable time-delay element, wherein
- the VCO generates the control signals required for the power output stage,
- the power output stage provides stepped output voltage,
- the resonance converter converts the stepped output voltage from the power output stage into a motor voltage for driving the piezomotor, the motor voltage being sinusoidal and having an associated motor current when the piezomotor is driven,
- the phase comparator compares the motor current with the phase of the motor voltage, and provides a phase-difference signal representing a measure of the phase difference between motor current and the motor voltage,
- the phase-locked loop filter is configured to smooth the phase-difference signal so as to provide a smoothed signal that controls the VCO, and
- the adjustable time-delay element providing for controlled reduction of the phase difference between the motor voltage and the motor current in a start-up process for starting up the piezomotor from a large starting angle at initiation of the start-up process towards a smaller operating angle at an operating point, the adjustable time-delay element effecting the reduction in the form of one of: (i) a preset linear gradient, the linear gradient having a preset starting delay, a preset final delay and a preset, fixed change in delay per selected time increment over the duration of the start-up process, such that, at initiation of the start-up process, the starting delay applies to generate a start-up phase angle toward enabling reliable start up of the piezomotor and, at the operating point, the final delay applies to generate an operating phase angle toward enabling reliable operation of the piezomotor, or (ii) a preset progressive curve, the progressive curve having a preset starting delay, a preset final

delay and a preset, varying change in delay per selected time increment over the duration of the start-up process, such that, at initiation of the start-up process, the starting delay applies to generate a start-up phase angle toward enabling reliable start up of the piezomotor, and, as the operating point is neared, the change in delay per selected time increment becomes progressively smaller and, at the operating point, the final delay applies to generate an operating phase angle toward enabling reliable operation of the piezomotor, or (iii) a preset combination of a linear gradient and a progressive curve.

11. (Canceled)

12. (Previously Presented) The starting-process controller of claim 10, wherein the adjustable time-delay element comprises a digital counter, and wherein the digital counter effects the controlled reduction in phase angle between the motor voltage and the motor current in the form of the linear gradient, the progressive curve or the combination of such gradient and curve.

13. (Previously Presented) The starting-process controller of claim 12, wherein, at selected times during the start-up process, the digital counter has respective starting values such that the starting value of the digital counter at a particular selected time fixes the respective delay as to the motor current, the delay generating a phase angle at such selected time.

14. (Previously Presented) The starting-process controller of claim 13, wherein the digital counter counts from each starting value to a preset final count, the final count being associated with the passing on of the motor current subject to the respective delay.

15. (Previously Presented) The starting-process controller of claim 13, further comprising a start-up process delay controller, the start-up process delay controller controlling the adjustable time-delay element by one or both of (i) providing the

starting values to the digital counter of the adjustable time-delay element and/or (ii) having a timing interval associated with the selected time increment between changes in delay.

16. (Previously Presented) The starting-process controller of claim 10, further comprising a start-up process delay controller, the start-up process delay controller controlling the adjustable time-delay element by one or both of (i) providing one or more of the starting delay, the final delay and/or the change in delay and/or (ii) having a timing interval associated with the selected time increment between changes in delay.

17. (Previously Presented) The starting-process controller of claim 16, wherein the start-up process delay controller comprises a reference counter that counts oscillations of a reference frequency, the reference frequency forming a clock signal of the reference counter.

18. (Previously Presented) The starting-process controller of claim 17, wherein the counts made by the reference counter are used directly for setting the delay.

19. (Previously Presented) The starting-process controller of claim 17, wherein the counts made by the reference counter are converted into a value for setting the delay.

20. (Previously Presented) The starting-process controller of claim 17, wherein the counts made by the reference counter are converted into settings for the delay by means of a table of a memory device.

21. (Previously Presented) The starting-process controller of claim 10, wherein the starting process is monitored by a programmable control device.

22. (Previously Presented) The starting-process controller of claim 21, wherein the programmable control device monitors the phase delay digitally.

23. (Previously Presented) The starting-process controller of claim 10, wherein an output of the adjustable time-delay element is directly connected to an input of the phase comparator.

24. (Previously Presented) The starting process controller of claim 10, wherein the adjustable time-delay element delays only one of the motor voltage and the motor current, and provides the delayed one of the motor voltage and the motor current to the input of the phase comparator.

25. (Previously Presented) The starting-process controller of claim 10, wherein the adjustable time-delay element includes a binary counter whose output is provided to the input of the phase comparator.

26. (Previously Presented) A starting-process controller for starting a piezomotor, comprising:

a voltage-controlled oscillator (VCO) adapted to generate a control signal;

a power output stage adapted to receive the control signal from the VCO and in response thereto to generate a stepped output voltage;

a resonance converter adapted to convert the stepped output voltage from the power output stage into a motor voltage for driving the piezomotor, the motor voltage being sinusoidal and having an associated motor current when the piezomotor is driven;

an adjustable time-delay element adapted receive the motor current and to delay the motor current by a delay amount;

a phase comparator adapted to receive the motor voltage and the delayed motor current from the adjustable time-delay element, and to output a phase-difference signal representing a measure of a phase difference between the delayed motor current and the motor voltage; and

a phase-locked loop filter adapted to filter the phase-difference signal and to apply the phase-difference signal to the VCO.

27. (Previously Presented) The starting-process controller of claim 23, wherein during an initial start-up period of the piezomotor, the adjustable time-delay element is adapted to adjust the delay amount linearly from a preset start-up delay value to a preset final delay value, the adjustable time-delay element being further adapted to provide a preset, fixed change in the delay amount per selected time increment over a duration of the initial start-up period.

28. (Previously Presented) The starting-process controller of claim 27, wherein the adjustable time-delay element comprises:

a binary counter adapted to load a count value corresponding to the preset start-up delay value and to receive a clock signal corresponding to a frequency of the VCO, and to provide a counter output value that changes linearly at each cycle of the clock signal;

a programmable counter adapted to receive the motor current and to load the counter output value from the binary counter in response to the motor current, and is further adapted to receive a clock signal, to count in response to the clock signal, and to output the delayed motor current; and

a comparator adapted to receive the counter output value and a value corresponding to the preset final delay value, to compare the counter output value to the preset final delay value, and to output a stop signal to the binary counter to disable further counting when the counter output value equals the preset final delay value.

29. (Previously Presented) The starting-process controller of claim 23, wherein during an initial start-up period of the piezomotor, the adjustable time-delay element is adapted to adjust the delay value along a progressive curve from a preset start-up delay value to a preset final delay value such that a change in the delay value per

selected time increment is greater at a beginning of the initial start-up period and is less at an end of the initial start-up period.

30. (Previously Presented) The starting-process controller of claim 29, wherein the adjustable time-delay element comprises:

a binary counter adapted to load a count value corresponding to the preset start-up delay value and to receive a clock signal corresponding a frequency of the VCO, and to provide a counter output value that changes at each cycle of the clock signal;

a look-up table adapted to receive the count value from the binary counter and to an output a table value corresponding to the received count value, the look-up table being adapted to map the count value to the table value such that the delay is adjusted along the progressive curve from the preset start-up delay value to the preset final delay value such that the change in delay per selected time increment is greater at the beginning of the initial start-up period and is less at the end of the initial start-up period; and

a programmable counter adapted to receive the motor current and to load the output table value from the look-up table in response to the motor current, and is further adapted to receive a clock signal, to count in response to the clock signal, and to output the delayed motor current.

EVIDENCE APPENDIX

{None}

RELATED PROCEEEDINGS APPENDIX

{None}